DOCUMENT RESUME

ED 427 015 TM 029 351

AUTHOR Dowson, Martin; McInerney, Dennis M.
TITLE Cognitive and Motivational Determinants of Students' Academic Performance and Achievement: Goals, Strategies, and Academic Outcomes in Focus.
PUB DATE 1998-04-00
NOTE 18p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998).
PUB TYPE Numerical/Quantitative Data (110) -- Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; *Cognitive Processes; *Educational Objectives; Foreign Countries; Junior High Schools; Learning Strategies; Longitudinal Studies; Males; *Metacognition; Middle Schools; School Culture; Secondary School Teachers; *Student Motivation; Tables (Data)
IDENTIFIERS Australia; *Mastery Orientation; *Middle School Students

ABSTRACT

The relationships between middle school students' multiple motivational goal orientations and their use of multiple cognitive and metacognitive strategies were studied with a focus on relations between these motivational and cognitive variables and students' academic achievement in two curriculum areas. Participants were 602 middle school students from 4 high schools in the Sydney (Australia) metropolitan area. Studies to date typically have used either cognitive or motivational variables when attempting to account for variations in students' achievement, but in this study, a dual approach combining cognitive and motivational variables was used. Students' mastery goals were most strongly associated with their strategy use. The findings validate the salience, for Australian middle school students, of various motivational goals, cognitive strategies, and metacognitive strategies identified in international research. (Contains 6 tables, 4 figures, and 21 references.) (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 427 015

Cognitive and motivational determinants of students' academic performance and achievement: Goals, strategies, and academic outcomes in focus.

Martin Dowson
Dennis M. McInerney
University of Western Sydney, Macarthur

Paper presented at the annual meeting of the American Educational Research Association

San Diego
April, 13-17, 1998

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
Martin Dowson
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This paper investigates relations between middle school students' multiple motivational goal orientations and their use of multiple cognitive and metacognitive strategies. The paper also focuses on relations between these motivational and cognitive variables and students' academic achievement in two curriculum areas. Studies to date have, typically, used either cognitive or motivational variables when attempting to account for variations in students' achievement. Far fewer studies have combined cognitive and motivational variables in order to gain a more complete understanding of the processes underlying students' achievement. This present paper, however, contributes to recent research using this 'dual' approach. Moreover, the paper further validates the salience, for Australian middle school students, of various motivational goals, cognitive strategies, and metacognitive strategies identified in international research.

TM029351

MARTIN DOWSON is a Lecturer in the Faculty of Education at the University of Western Sydney, Macarthur, PO Box 555, Campbelltown, NSW, Australia 2259. E-mail: m.dowson@uws.edu.au. His specialisations are learning and motivation.

DENNIS M. MCINERNEY is an Associate Professor in the Faculty of Education at the University of Western Sydney, Macarthur, PO Box 555, Campbelltown, NSW, Australia 2259. E-mail: d.mcinerney@uws.edu.au. His specialisations are cross-cultural learning and motivation.

BEST COPY AVAILABLE

Purpose

The primary purpose of the present study is to:

(a) identify relations between salient motivational and cognitive correlates of students' academic achievement in different curriculum domains.

A secondary purpose of the study was to:

(b) demonstrate the validity of using multiple motivational *and* cognitive variables to account for students' academic performance and achievement in different curricula domains.

Theoretical Orientation

Most educators agree that effective learning involves the ability to self-regulate a variety of thoughts, feelings, and actions associated with learning processes (eg. Meece, 1994; Schunk, 1991; Zimmerman, 1990). In particular, the ability to activate, and appropriately apply, a variety of cognitive and metacognitive strategies in order to acquire specific content has been strongly implicated in the quality of students' academic performance and the extent of their achievement (Meece, 1994; Derry, 1990). In response to this, recent research has focused on the nature and function of the cognitive and metacognitive strategies students use (or do not use) to acquire, integrate, and retrieve information (Hong, 1995; Zimmerman & Martinez-Pons, 1988).

Theoretical models using cognitive and metacognitive strategies to explain variations in students' achievement have, however, not always adequately explained (a) why students may or may not (particularly in 'real life' classroom situations) activate strategies during given learning tasks, and (b) why students fail to transfer relevant strategies from one task or situation to another (Pintrich & Schrauben, 1992). In other words, these cognitive models have not always adequately explained why students may, or may not, expend *effort* to activate and/or transfer strategies. This is particularly important because successful activation and transfer of strategies *requires* effort. If students do not expend appropriate effort their strategic knowledge will be rendered ineffective (or, at least, be of reduced effectiveness) in contributing to their academic performance.

The *selective* activation and transfer of strategies may be attributed to purely cognitive factors such as routinisation, effective encoding, and the productive use of self-regulatory processes (Schneider & Pressley, 1989). However, recent research indicates that strategy activation and transfer is also dependent upon a variety of motivational variables (Graham & Golan, 1991; Meece, Blumenfeld, & Hoyle, 1988). Hence, students' level of *cognitive engagement* (the extent to which students activate and transfer prior knowledge and strategies) is a function of *both* motivational *and* cognitive factors working together (Pintrich & Schrauben, 1992). In particular, students' motivational goals (the purposes they espouse for wanting to achieve in academic situations) have been implicated in the quality of students' cognition and their subsequent academic achievement (Meece, 1994; Pintrich & Schrauben, 1992).

Despite this, the *interaction* of motivational and cognitive variables, such as students' goals and strategies, in explaining students' cognitive engagement and subsequent academic achievement, has been largely avoided or ignored. With some exceptions it has, until recently, been more common to explain students' performance and achievement in *either* motivational *or* cognitive terms rather than through a combination of both. Examining the interaction of motivational and cognitive variables,

however, as the present study does, should help explain more fully the functioning of students' cognitive processes and the effect(s) these have on students' achievement. (Borkowski, Carr, Rellinger, & Pressley, 1990; Pintrich & Schrauben, 1992).

Research Model

In order to facilitate such an examination, the present study proposes a research model linking students' goal orientations (their purposes for academic achievement) with their strategy use, and academic achievement. Consistent with the literature reviewed above, the model proposes that students' goal orientations influence their strategy use which, in turn, influences their academic achievement. A simplified version of the research model is presented diagrammatically below.

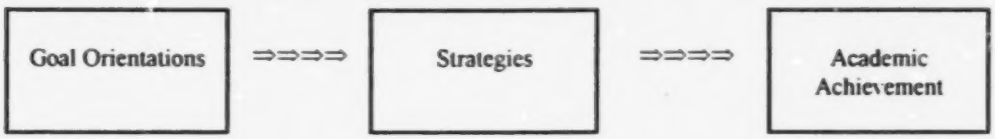

Figure 1. Simplified version of the research model guiding the present research.

Producing initial estimates for the parameters of the research model will be the particular focus of Analyses One and Two (described below). Also of interest, however, is the question as to whether (or not) the causal chain implied in the model above can be supported by the data in this study. Theoretically, it makes sense to posit that students' motivational orientations influence their strategies which, in turn, influence their achievement outcomes. However, it is also possible that the students' goal orientations may directly influence their achievement without being mediated by their strategy use. The issue of causality amongst the variables in the research model will be the particular focus of Analysis Three (also described below).

Method

Participants

The data in the study represent responses from six-hundred and two (602) middle school students attending four (4) high schools in the Sydney metropolitan region. The schools were selected from a range of geographic and educational regions within the Sydney metropolitan area. Approximately equal numbers of male and female students from a wide cross-section of cultural, socioeconomic, and academic backgrounds are represented in the sample. Demographic statistics for the participants are presented in Table One below.

Table 1
Students' Demographic Data

Age	*12 years*	*13 years*	*14 years*	*15 years*	*Average*
	112 (19%)	206 (34%)	221 (37%)	63 (10%)	13.3 years
Gender	*Female*	*Male*			
	328 (54.5%)	274 (45.5%)			
Year at School	*Year 7*	*Year 8*			
	318 (53%)	284 (47%)			
Place of Birth	*Australia*	*Overseas (English Speaking)*	*Overseas (Non-English Speaking)*		
	476 (79%)	30 (5%)	96 (16%)		

Measures

The study surveyed the participants to determine their multiple motivational goal orientations and their use of cognitive and metacognitive strategies. The instrument used to collect these data was the Goal Orientation and Learning Strategies Survey (GOALS-S), the psychometric properties of which have been established in a previous study (Dowson & McInerney, 1997a). Specifically, the GOALS-S was designed to measure a selection of academic goals (n=3), social goals (n=5), cognitive strategies (n=3) and metacognitive strategies (n=3). Table Two provides brief definitions of each of the academic and social goals measured by the GOALS-S as well as a sample item from the GOALS-S used to measure these goals.

Table 2
GOALS-S Scales Measuring Students' Social and Academic Goals

Category/Goal	Definition
Academic Goals	The academic reasons students espouse for wanting to achieve in academic situations.
Mastery	Wanting to achieve academically in order to demonstrate understanding, academic competence, or improved performance relative to self-established standards. **Sample Item:** I want to do well at school to show that I can learn new things.
Performance	Wanting to achieve academically in order to demonstrate ability, out-perform other students, attain certain grades /marks, or to obtain tangible rewards associated with academic performance. **Sample Item:** I try to do well in school so that I get better marks in school than other people.

Work Avoidance	Wanting to achieve academically with as little effort as possible. Conversely, avoiding demanding achievement situations in order to minimise expended effort. **Sample Item:** I always choose easy work at school so that I don't have too much trouble.
Social Goals	The social reasons students espouse for wanting to achieve in academic situations.
Social Affiliation	Wanting to achieve academically in order to enhance a sense of belonging to a group or groups and/or to build or maintain inter-personal relationships. Conversely, wanting to achieve in order to avoiding feelings of separateness or isolation. **Sample Item:** I want to do well at school so that I can feel close to my group of friends.
Social Approval	Wanting to achieve academically in order to gain the approval of peers, teachers, and/or parents. Conversely, wanting to achieve in order to avoid social disapproval or rejection. **Sample Item:** I want to do well in my schoolwork so that other people can tell me I did well.
Social Conformity	Wanting to achieve academically in order to show compliance with, or avoid transgression of, particular rules and procedures which apply in academic achievement situations. **Sample Item:** I do good schoolwork so that I don't have any trouble with my parents or teachers.
Social Responsibility	Wanting to achieve academically out of sense of responsibility to others and/or in order to maintain interpersonal commitments, meet social role obligations, or follow social and moral 'rules'. Conversely, wanting to achieve in order to avoid social transgressions and/or unethical conduct. **Sample Item:** I want to do good schoolwork because it's other people expect it of me.
Social Status (Present and Future Orientations)	Wanting to achieve academically in order to maintain or attain social position in school (present orientation) or later life (future orientation). Conversely, wanting to achieve in order to avoid low status positions in either school or later life. **Sample Item:** I want to do well at school so that I will look good in front of my relatives.
Social Welfare	Wanting to achieve academically in order to be able to assist others in their academic or personal development. Conversely, avoiding academic achievement situations where the welfare of other students is at risk. **Sample Item:** When I do good schoolwork it's so that I can my friends can get help from me if they need it.

Table Three, below, provides brief definitions of, and sample items representing, the cognitive and metacognitive strategies measured by the GOALS-S.

Table 3
GOALS-S Scales Measuring Students' Cognitive and Metacognitive Strategies

Construct	Definition
Cognitive Strategies	Are the means by which students select, acquire, and integrate new knowledge with existing knowledge.
Elaboration	Refers to the formation of helpful connections between new and old information. Elaboration may involve paraphrasing, generating analogies, or reviewing previous work. **Sample Item:** When learning things for school try to see how they fit together with other things I already know.
Organisation	Refers to the ways in which students structure their knowledge in order to enhance the assimilation of new information. Organisation may involve selecting, sequencing, outlining, re-ordering or summarising important information. **Sample Item:** I rearrange my school notes when I want to learn things for school.
Rehearsal	Refers to the basic memorisation of factual information. Rehearsal may involve listing, memorising, reciting, and/or naming facts/items to be learned. **Sample Item:** When I want to learn things for school I practice repeating them to myself.
General Cognitive Strategies	In the present research refers to a combination of the three strategies above.
Metacognitive Strategies	Are the means by which students self-manage their learning behaviour and affect.
Monitoring	Refers to the implementation of self-checking and self-assessment measures. Monitoring may involve self-checking for understanding, self-testing, and organised reviews of previously learned material. Monitoring implies systematising attempts to evaluate the assimilation and organisation of learned material. **Sample Item:** I often ask myself questions to see if I understand what I am learning.
Planning	Refers to the implementation of self-directed organisational strategies designed to enhance learning. Planning may involve prioritising, time management, scheduling, setting realistic goals, and arranging work environments appropriately . Planning implies thoughtful preparation for completing work. **Sample Item:** Before trying to learn things for school I try to decide what are the most important parts of what I am trying to learn.

Regulation	Refers to the implementation of strategies designed to counter difficulties identified when monitoring. Specific regulatory strategies may include attempting different ways to learn material, seeking explanations from teachers, or correcting mistakes in reasoning. **Sample Item:** If I need to, I change the way I study so that I can learn new things.

As indicated, item scales, of which the sample items above are examples, were devised to measure each of the constructs. The factorial validity of the scales was assessed using Confirmatory Factor Analyses (CFAs) in Linear Structural Relations (LISREL), Version 7 (Joreskog & Sorbom, 1989). Some variations to the composition of the scales were made during the CFAs. Only scales which demonstrated substantial validity were included in the present research. The fit statistics for the one-hundred items measuring the constructs above, as well as other constructs not included in the present research, are presented in Table Four.

Table 4
Fit Statistics for the GOALS-S Items

Model Description	CHISQ	df	CHI/df	GFI	AGFI	RMSR	TLI	RNI
Null Model	95366.70	4950	19.266	0.000	0.000	0.000	0.000	0.000
Hypothesised Model	8829.27	4679	1.887	0.963	0.914	0.037	0.904	0.916

Note
Chisq = chi-square value
df = degrees of freedom
Chisq df = chi-square degrees of freedom ratio
GFI = Goodness-of-fit index
AGFI = Adjusted goodness-of-fit index
RMSR = Root mean square residual
TLI = Tucker-Lewis index
PNI = Parsimony relative non-centrality index

$$TLI = \frac{[\text{Chi-square degrees of freedom (null model)}] - [\text{Chi-square degrees of freedom (hypothesised model)}]}{\text{Chi-square (degrees of freedom -1) (null model)}}$$

$$PNI = \frac{[\text{Chi-square - degrees of freedom (null model)}] - [\text{Chi-square - degrees of freedom (hypothesised model)}]}{\text{Chi-square - (degrees of freedom -1) (null model)}}$$

The statistics in Table Four confirm the substantial validity of the GOALS-S scales. The reliability of each of the scales was also confirmed. Chronbach's Alpha for the scales ranged between 0.77 and 0.91. For the present study, the means of each of the scales were used in the path analyses described below.

In addition to the above scales, the study collected data for students' academic performance in two curriculum areas: Mathematics and English. Students' academic performance in these areas was represented by their end-of-year examination results which were standardised between curriculum areas and schools.

After listwise deletion of cases, five-hundred and sixty-one cases were available for further analysis. Relations between students' motivational orientations, cognitive and metacognitive strategy use, and academic achievement in the two curricula domains were assessed using path analyses within in LISREL V.7. All paths in each analysis were assessed simultaneously. This meant that the coefficient associated with each path represents the unique association of the two variables linked by that path without 'interference' from other paths (relationships) in the model. In other words, all paths were assessed taking into account the intercorrelations between all variables in the model.

For the purposes of clarity, the path analyses are reported in three separate, but related, sections below. Analysis One describes relations between students' goals and strategies (the first part of the research model). Estimates of relations between these variables were ascertained from the initial path analysis. Analysis Two describes relations between students' strategies and their academic achievement (the second part of the model). Estimates of relations between these variables were also ascertained from the initial path analysis. Analysis Three selects the most important motivational and cognitive variables associated with students' achievement (as identified in Analyses One and Two) and combines them in a second, simplified, path model. This simplified path model estimates ('from scratch') all direct and indirect paths linking students' goals and strategies with their achievement outcomes. A key aim of this approach, as indicated earlier, was to ascertain whether (or not) the direct paths linking students' goals to their achievement outcomes were stronger (or weaker) than the indirect paths linking students' goals to their achievement outcomes through their strategy use. In this way the appropriateness of the causal linkages in the research model was assessed.

Analysis One

As indicated above, Analysis One investigates relations between students' goal orientations and their strategy use. This set of relationships is represented diagrammatically below.

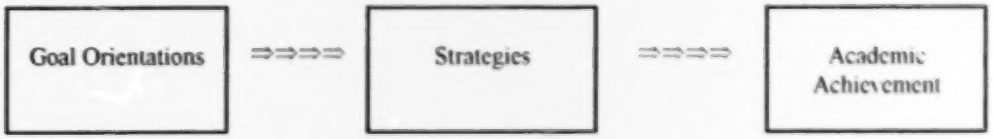

Figure 2. Relations between students' goal orientations and their strategy use

Results

The table of path coefficients between students' goal orientations and their strategy use is presented below. Significant results at the 0.05 level are bold-faced. Significant results at the 0.001 level are bold-faced and asterixed.

Table 5

Path Coefficients Linking Students' Goal Orientations and their Strategy Use

	MASTERY	PERFORM	WORKAV	AFFILATE	APPROVAL	CONFORM
COGGEN	**.454***	.043	-.035	.065	**.294***	.066
PLAN	**.317***	.017	**-.289***	**.181**	**.279***	**.251***
REGULATE	**.267***	**-.199**	-.059	.037	.034	**.283***
MONITOR	**.335***	.041	**-.228***	-.053	.050	.037

	RESPONSB	STATUSP	STATUSF	WELFARE
COGGEN	.006	**.338***	**.205***	**.218***
PLAN	**.307***	.015	.026	.046
REGULATE	.048	**.198**	.067	**.196**
MONITOR	.000	-.002	.007	.033

Key:

Mastery	= Mastery Goal Orientation	Coggen	= General Cognitive Strategies
Peform	= Performance Goal Orientation	Plan	= Planning
Workav	= Work Avoidance Goal Orientation	Regulate	= Regulation
Affilate	= Social Affiliation Goal Orientation	Monitor	= Monitoring
Approval	= Social Approval Goal Orientation		
Conform	= Social Conformity Goal Orientation		
Responsb	= Social Responsibility Goal Orientation		
Statusp	= Social Status (Present) Goal Orientation		
Statusf	= Social Status (Future) Goal Orientation		
Welfare	= Social Welfare Goal Orientation		

.000 = Path significant at the .05 level
.000* = Path significant at the .001 level

Table Five indicates that students' mastery goal orientations are clearly most strongly associated with their use of a variety of cognitive and metacognitive strategies. That is, of four possible paths, four highly statistically significant paths were estimated. The next most strongly associated goals are students' work avoidance, social approval, and social conformity orientations, each with two highly significant paths estimated out of four possible paths. Not surprisingly, students' work avoidance goals are negatively associated with their use of cognitive and metacognitive strategies. All other goals in the study, with the exception of students' performance goals, were positively associated with their strategy use.

Discussion

As indicated above, students' mastery goals are most strongly associated with their strategy use. This result is consistent with the literature which has found that, using a variety of methodologies and samples, students who are motivated to achieve academically in order to understand (or master) academic work are much more likely to employ strategic approaches to learning even if these require greater effort than less strategic approaches (Ainley, 1993; Graham & Golan, 1991).

Also as indicated, two of students' social goals, their desire to achieve academically in order to win the approval of others (social approval) and their desire to achieve academically in order to conform to social expectations (social conformity) are quite strongly associated with their strategy use. This finding is interesting for two

reasons. First, it confirms not only that students' academic reasons for achievement are associated with their strategy use, but also that students' social reasons for achievement are associated with their strategy use. Second, this finding confirms that externally referenced motivations for learning and achievement (for example, in the present case, being approval or conformity oriented) are not *necessarily* detrimental to strategic approaches to learning. Much has been said in the literature about the, potentially, maladaptive effects of externally referenced, versus internally referenced, motivations for learning and achievement (Dweck, 1992; Deci & Ryan, 1985). Consistent with other studies, however (eg. Dowson & McInerney, 1997b; Pintrich, Marx, & Boyle, 1993), the present study has found that externally referenced motivations may not, necessarily, be detrimental to adaptive (strategic) approaches to learning. This may be especially true when externally referenced motivations are held in combination with other, internally referenced, motivations.

Analysis Two

Analysis Two examined relations between students' strategy use and their academic achievement. This set of relationships is represented diagrammatically below.

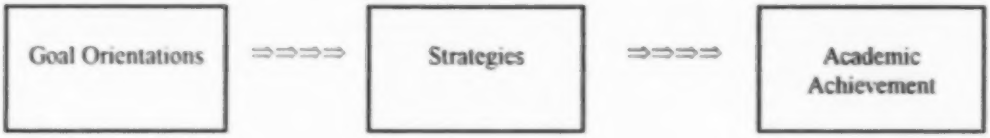

Figure 3. Relations between students' goal orientations and their strategy use

Results

The table of path coefficients between students' strategies and academic achievement is presented below (Table Five). As above, significant results are bold-faced, or bold-faced and asterixed, to indicate their significance.

Table 6
Path Coefficients Linking Students' Strategy Use and their Academic Achievement

	COGGEN	PLAN	REGULATE	MONITOR
MATHS	**.299***	.039	**.203***	**.253***
ENGLISH	.037	.031	**.290***	**.274***

Key:
Coggen = General Cognitive Strategies
Plan = Planning
Regulate = Regulation
Monitor = Monitoring

.000 = Path significant at the .05 level
.000* = Path significant at the .001 level

Table Six indicates that students' regulatory and monitoring strategies are associated most strongly with their academic achievement. Students' general cognitive strategies are significantly associated with their mathematics achievement but not with their English achievement. Students' planning strategies are associated, in this study, with neither their mathematics or English achievement.

Discussion

The results of Analysis Two indicate the following. First, both students' cognitive and metacognitive strategies are associated with enhanced academic achievement. This reinforces the importance of students' not only using strategies but also of students' having available a *range* of appropriate strategies from which to choose in given academic situations. Cantwell (1992) calls this a flexible approach to strategy use.

Second, some strategies appear portable across curriculum areas. In the present study, for example, students' regulatory and monitoring strategies are associated with both their mathematics and English achievement. Thus, the strategic practices used in one academic context (eg. mathematics) appear useful in other contexts (eg. English) as well. This said, it should not be assumed that every strategy will be equally useful in every academic context. In the present study, students' general cognitive strategies were associated their mathematics achievement but not their English achievement. This result may be an artefact of content, instructional, or assessment practices which differ between particular curricula areas. Whatever the case, however, these results again highlight the potential importance of having available a variety of strategies from which to choose. In the present case, for example, it is possible to speculate that students' who only had general cognitive strategies on which to call may have experienced more difficulty in English than those with other metacognitive strategies on which to call (such as regulatory or monitoring strategies). These metacognitive strategies may compensate for a potential deficit in the effectiveness of students' general cognitive strategies with respect to this particular curriculum area.

Third, some strategies may not be effective in more than one curriculum area. The interesting result that students' planning strategies are neither associated with their Mathematics or English achievement scores reinforces the point, made above, that particular strategies may not necessarily be associated with students' academic achievement. In the present case, it could be hypothesised that middle school students may not need planning strategies in order to be academically successful. Approaches to middle school curricula might, for example, be expected to be more teacher-directed than student-directed. If so, then students' planning strategies may be largely redundant in these contexts. Whatever the case, in the present study, middle school students' planning strategies were clearly not as strongly associated with students' academic achievement as other strategies investigated.

Analysis Three

Based on the results of Analyses One and Two, Analysis Three sought to estimate a simplified path model, which could be used to provide a parsimonious description of relations between students' motivational goals, strategy use, and achievement outcomes. The simplified model was also to be used to ascertain whether the causal linking of variables in the research model could be supported.

Results

The results of Analyses One (Table Five) and Two (Table Six) give some direction to the development of a simplified model. First, for the reasons indicated immediately above, it is possible to remove students' planning strategies from the research model. That is, the present study is primarily interested in relations between students' goals and strategies and their achievement outcomes. Therefore, students' planning strategies, which are not directly linked to their achievement outcomes, fall outside the immediate interest of the present study. Future studies, however, may investigate further why, in this study at least, students' planning strategies are not linked to their achievement outcomes

If students' planning strategies are removed from the model, then paths linking students' motivational goals to their use of planning strategies would also be omitted. If this is done with the initial model then, clearly, students' mastery goals are most strongly associated with their strategy use of all the goals in the study. That is, even with the omission of the path linking students' mastery goals to their planning strategies, students' mastery goals are still linked to the three remaining strategies by three highly statistically significant ($p < 0.001$) paths. This compares to only one highly statistically significant path for any other goal in the model. Thus, of the ten original motivational goals examined in the study, one goal, mastery, appears to be the most salient indicator of students' strategy use.

It should still be recognised, however, that even with the omission of paths linking students' goals to their planning strategies, six goals, other than students' mastery goals, remain linked by one highly significant path to students' strategy use in the initial model. Moreover, two of these six goals, students' social status (present) and social welfare goals; are also linked to students' strategy use by an additional significant ($p < 0.05$), although not highly significant path. It would seem reasonable, then, to include these variables in a simplified model. Students' performance goals, however, are only linked to their regulatory (and no other) strategies by one significant, although not highly significant, path. For this reason, it would seem reasonable to remove students' performance goals from the simplified model.

Figure Four represents the simplified model of relations between students' goals, strategies, and achievement outcomes. This model includes the seven goals, and three strategies, remaining after the modifications indicated above were made. Only significant paths linking these variables are included in Figure Four (with highly significant paths bold-faced).

Insert Figure 4 about here.

As might be expected, the removal of variables from the initial model resulted in some changes to parameter estimates (path coefficients) in the simplified model (when compared with the initial path model). These changes are, however, relatively minor. Moreover, they result, only, in the deletion of two significant paths (one each emanating from social status (present) and social welfare). Thus, the overall integrity of the model was maintained upon re-estimation.

Discussion

Figure Four simplifies the original research model considerably. The original model estimated fourty-eight (48) hypothesised paths. The simplified model represents the sixteen (16) most salient paths implicated in students' achievement. Despite this,

Figure Four still indicates that students' mathematics and English achievement may be linked to their use of a variety of cognitive and metacognitive strategies which, in turn, are related to their various social and academic goal orientations.

The simplified model also supports the causal chain implicated in the original research model. Only two significant ($p < 0.05$), but not highly significant ($p < 0.001$), paths link students' goals directly with their achievement. These paths link students' work avoidance ($p = -0.20$) and social welfare ($p = 0.22$) orientations to their English achievement. All other paths (nine in total: eight highly significant and one significant) linked students' goals to their achievement only *indirectly* through their strategies. Thus, the data do not substantially contradict the causal linkages implied in the research model.

Summary and Recommendations

Taken as a whole, the analyses above confirm that students' achievement is associated with a complex, but reasonably well defined, set of relations between students' motivational orientations and cognitive processes. Thus, students' academic achievement should not be seen, purely, as the product of a set of cognitive variables working together. Rather students' achievement should be conceptualised as being underpinned by a web of interacting cognitive processes *and* motivational orientations which work together to influence students' academic achievement (Wentzel, 1991). The present study, then, implicates both the validity and desirability of including multiple motivational and cognitive variables in studies attempting to account for students' academic achievement.

Conversely, the present study mitigates against approaches which might use only motivational *or* cognitive variables to account for students' achievement. Such studies may minimise both the complexity and diversity of variables associated with students' academic achievement. As indicated in the theoretical orientation to this paper, cognitive models of learning have, not atypically, conceptualised cognitive processes (of which the application of strategies is one) as 'cold' ie. not impacted upon by motivational, social, or other variables. The present research, in contrast, suggest that students' cognition is a 'hot' process ie. influenced, or at least associated with, motivational variables. Thus, students' strategic approaches to their learning are not implemented without regard for the purposes students' have with respect to their learning. Put more simply, *how* students learn is associated with the reasons *why* students want to learn.

The present study also confirms evidence gathered over the previous fifteen years, in particular, which has implicated the role of students' strategy use in their academic achievement. This trend continues, with very recent studies also suggesting that systematic training in, and application of, a variety of strategies improves academic performance (eg. Mifsud, Evans, & Dowson, 1997). The present study also confirms, however, that not every strategy will be maximally useful in every situation. Thus, the present study supports the differential utility of various strategies, across different curricula domains, despite extensive relations between students' strategy use and achievement overall.

On the basis of the above, it seems reasonable to recommend that future studies should continue to use combinations of motivational and cognitive variables when assessing students' academic performance and achievement. Moreover, the particular ordering of these variables, with goals influencing strategies which, in turn, influence

students' achievement outcomes; should also serve as a starting point for these studies. Whilst the pattern of relations between these variables might be expected to vary from study to study, the overall strategy of conceptualising and operationalising academic achievement as the product of a 'hot' process involving motivational and cognitive variables seems to be both applicable and desirable on the basis of this, and related, studies.

Practitioners should also recognise that both motivational and cognitive processes are associated with students' achievement. Specifically, both the academic *and* the social reasons students' espouse for wanting to achieve may be associated with their engagement in learning and their subsequent academic achievement. This said, it is particularly clear that mastery motivated students may be expected to adopt a broad range of strategic approaches to learning which result in enhanced academic achievement. Both researchers and practitioners should, therefore, be particularly concerned to facilitate mastery motivation amongst their students as a means of promoting strategic approaches to learning.

References

Ainley, M.D. (1993). Styles of engagement with learning: Multidimensional assessment of their relationship with strategy use and school achievement. *Journal of Educational Psychology*, 85, 395-405.

Borkowski, J., Carr, M., Rellinger, E., & Pressley, M. (1990). Self-regulated cognition: Interdependence of meta-cognition, attributions, and self-esteem. In B.F. Jones, & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 53-92). Hillsdale: NJ: Lawrence Erlbaum.

Cantwell, R.H. (1992, November). *The mindful control over learning: The relationship between dispositions towards task engagement and dispositions towards control over task engagement*. Paper presented at the second joint AARE/NZARE Conference: Canberra.

Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenam.

Derry, S.J. (1990). Learning strategies for acquiring useful knowledge. In B.F. Jones, and L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 347-380). Hillsdale, NJ: Lawrence Erlbaum.

Dweck, C.S. (1992). The study of goals in psychology. *Psychological Science*, 3, 165-167.

Dowson, M., & McInerney, D.M. (1997a, March). *The development of the Goal Orientation and Learning Strategies Survey (GOALS-S)*. Paper presented at the annual meeting of the American Educational Research Association, Chicago.

Dowson, M., & McInerney, D.M. (1997b, March). *Psychological parameters of students' social and academic goals: A qualitative investigation*. Paper presented at the annual meeting of the American Educational Research Association, Chicago.

Graham, S., & Golan, S. (1991). Motivational influences on cognition: Task involvement, ego involvement, and depth of information processing. *Journal of Educational Psychology*, 83, 187-196.

Hong, E. (1995). A structural comparison between state and trait self-regulation models. *Applied Cognitive Psychology*, 9, 333-349.

Joreskog, K., & Sorbom, D. (1989). *Linear Structural Relations, Version 7*. Baltimore: Scientific Software Inc.

Meece, J.L. (1994). The role of motivation in self-regulated learning. In D.H. Schunk, & B.J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications*. Hillsdale, NJ: Lawrence Erlbaum.

Meece, J.L., Blumenfeld, P.C., & Hoyle, R.H. (1988). Student's goal orientation and cognitive engagement in classroom activities. *Journal of Educational Psychology*, 80, 514-523.

Mifsud, S., Evans, D., & Dowson, M. (1997, September). *Strategy Training and Spelling Performance*. Paper presented at the Australian Association for Special Education (AASE), Brisbane.

Pintrich, P.R., Marx, R.W., & Boyle, R.A. (1993). Beyond cold conceptual change: The role of motivational beliefs and classroom contextual factors in the process of conceptual change. *Review of Educational Research*, 63, 167-199.

Pintrich, P.R., & Schrauben, B. (1992). Student's motivational beliefs and their cognitive engagement in classroom academic tasks. In D. Schunk, and J. Meece (Eds.), *Student perceptions in the Classroom: Causes and Consequences* (pp. 149-183). Hillsdale, NJ: Lawrence Erlbaum.

Schneider, W., & Pressley, M. (1989). *Memory Development Between 2 and 20*. New York: Springer-Verlag.

Schunk, D. (1991). Goal setting and self-regulation: A social cognitive perspective on self-regulation. In M.L. Maehr, & P.R. Pintrich (Eds.), *Advances in motivation and achievement. A research annual, Vol. 7* (pp. 85-113). Greenwich, CT: JAI Press.

Wentzel, K.R. (1991). Social and academic goals at school: Motivation and achievement in context. In M.L. Maehr, & P.R. Pintrich (Eds.), *Advances in motivation and achievement. A research annual, Vol. 7* (pp. 185-212). Greenwich, CT: JAI Press.

Zimmerman, B.J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist*, 25, 3-18.

Zimmerman, B.J., & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology*, 80, 284-290.

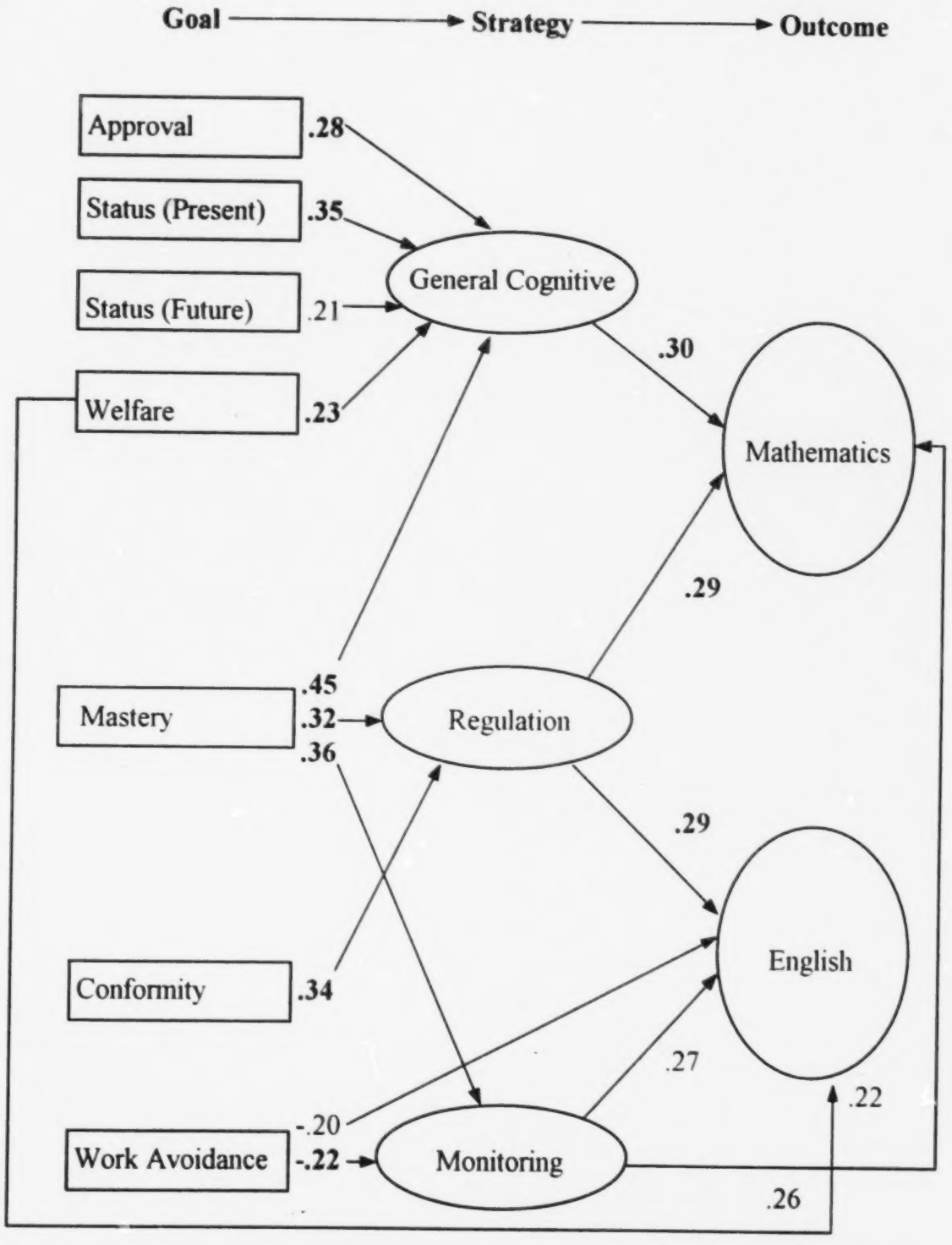

Figure 4. Relations between students' motivational orientations, strategy use, and academic achievement.